CHALLENGES OF TEACHING BASIC SCIENCE AND TECHNOLOGY (BST) IN NIGERIAN PUBLIC SCHOOLS: A CASE OF ANAMBRA STATE

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Abstract
This study investigated the challenges constraining effective teaching of BST in Nigerian public schools with emphases in Anambra state. A research question guided the study which adopted a descriptive survey research design. A sample of six hundred and sixty-one (661) was composed from a population of six thousand six hundred and fifteen (6615) BST teachers in the State by proportionate stratified random sampling technique. A 21-item, four-point rating Questionnaire, developed and validated by the researchers, was used for data collection. The instrument, with a reliability index of 0.75, was adjudged reliable and usable for the study. Data were analyzed using simple mean ratings. Results indicated among others that: BST curricular materials were adequately provided to schools (mean=2.99), instructional materials are inadequately supplied (mean=2.31), Relevant human resource were in short supply (mean=1.93) as well as Methodological
shortcomings (mean=2.28). Recommendations based on these findings were made.

Keywords: Challenges, Teaching, Learning, Basic Science and Technology,

Introduction
The Universal Basic Education (UBE) programme was launched in Nigeria on 30th September, 1999. This Programme was backed up by a legal instrument known as the Compulsory free Universal Basic Education Act of 2004. The constitution of the Federal Republic of Nigeria (FRN, 1999) provides a justification for this programme via section 5.18 (1) which stated that “government shall direct its policy towards ensuring that there are equal and adequate educational opportunities at all levels.” Furthermore, section 18 (3) of the same Document asserts that “government shall as and when practicable provide Free, Compulsory and Universal Primary Education, Free Secondary Education.” The present UBE programme covers the first nine years of formal education programme in Nigeria, ranging from the Lower Basic (first three years of primary school,) Middle Basic (primary school years 4-6) and Upper Basic education (the first three years of secondary school or the junior secondary school).

The UBE as a reform programme is in response to the government’s desire to attain the Millennium Development Goals (MDGs) by 2015 as well as the need to meet the critical targets of the National Economic, Empowerment and Development Strategies (NEEDS) summarized as: values re-orientation, poverty eradication, job creation, wealth generation and using education to empower the people. Towards this need, the existing primary science curricula was reviewed,
restructured and re-aligned to fit into the 9 year Basic Education. In addition, fundamental concepts of technology which hitherto was not taught in primary schools at all were infused to give a hybrid programme called Basic Science and Technology (BST) for lower and middle Basic Education (NERDC, 2006). Similarly, Federal Republic of Nigeria (FRN, 2013:13) enlisted BST as one of the core subjects at Junior Secondary Schools consisting of Basic science, Basic Technology, Information Technology and Physical and Health Education.

The general objective of BST education is to enable the learner to observe and explore the environment using their sense organs. The design of the curriculum is based on the idea of spirality of themes which are arranged from year one to year six. The thematic approach to content organization was adopted. The major recurrent themes are:

- You and Environment
- Living and Non-living things.
- You and Technology
- You and Energy

The spiral nature of these themes ensures that content become gradually difficult as learners progress from primary one to six. Also emerging issues which covered:

- Value orientation
- Peace and dialogue
- Human right education
- Family life/HIV AIDS education, and
- Entrepreneurial skills were infused into the relevant contents.
For each year, a main topic is given along with performance objectives, the contents, teacher and pupils’ activities, materials and evaluation guides.

In line with the general objectives of BST, the Federal Ministry Education (1992:5) outlined the specific objectives of teaching primary science (now BST) as:

(a) To enable Nigeria child to explore and observe his environment
(b) Develop basic science process such as observing, manipulating, classifying, communicating, inferring, hypothesizing, interpreting data and formulating models.
(c) Develop functional knowledge of science concepts and principles
(d) Explain simple natural phenomena
(e) Develop scientific attitude including curiosity, critical reflection and objectivity.

Generally, BST is an attempt to provide a holistic presentation of fundamental issues of science and technology to pupils. It is designed to expose pupils to developing science and technology skills, which will assist them, make informed decisions, develop survival strategies and learn to contribute and live effectively in the global community. In view of the afore-mentioned goals which BST is set to achieve, it is pertinent at this juncture to investigate the extent of attainment of these stated goals. In other words, are there impediments militating the realization of the stated goals? In specific terms: Are necessary curricular materials provided?, To what extent are trained human resource available, motivated and provided with the requisite material resources? What of methodology of instruction adopted in teaching BST?
Since this study was aimed at identifying the challenges constraining effective teaching of BST in Nigerian public schools with particular reference to Anambra state, it was equally necessary to do some status-update on the teaching and learning of BST in schools.

The WEF in 2015 GCR had noted that, Nigeria must improve on her infrastructure which undoubtedly includes those of Educational institutions, be it at primary, secondary or tertiary levels, for any sustainable growth through innovation (Akpan, 2008). To complement government effort towards providing an enabling environment for creativity and innovation, BST teachers have the responsibility of utilizing activity-based learning techniques and improvise the unavailable instructional materials within the local environment to engender students’ learning. On the part of the students, they are expected to:

i. Apply BST knowledge into new situations;
ii. Question all material things, objects and observed phenomena in the environment;
iii. Search for data and their meaning;
iv. Demand for verification and logical reasoning;
v. Be critical, creative and innovative in thinking

Evidence abound in literature on the constraints militating against effective teaching and learning of STEM. The WAEC Chief Examiners’ Report for WASSCE, 2016 for Agricultural Science, Biology, Chemistry, Mathematics and Physics, and a summary of the NABTEB Chief Examiners’ Report (2012-2017) for Technical Education which dwelt extensively on candidates’ weaknesses and suggested remedies, had earlier been reported elsewhere (Anaekwe, 2018). On a general note,
Aremu and Sokan cited in Tele and Gyang (2015), stated that the search for causation of students’ poor academic achievement is unending. Some of the factors often put forward as responsible include, but not limited to study habits, teachers consultation, association with wrong peers, parental factors, low motivation of teachers, abstract nature of science concepts. Morakinyo (2003), attributed the poor academic performance of secondary school students to teachers’ non-commitment to duty which manifests in a number of ways like poor attendance to lessons, lateness to school/class, unsavoury comments about students’ performance that could damage their ego, poor method of teaching among others.

Although most of the available literature centre around teaching constraints and students’ under-achievement in Science, Technology, Engineering and Mathematics (STEM), at the senior secondary school level, one would not take it for granted that all is well with BST at the lower levels. Indeed, it should be better understood that the observed under-achievement at the upper echelon of the education ladder, is a cumulative effect of deplorable conditions of teaching and learning of BST at the lower classes. For instance, the teacher quality and availability need not be compromised if standard is to be guaranteed. A situation where Teacher Education Institutions (Colleges of Education, Faculties of Education in Universities among others) has to date, continued to train specialist Integrated Science teachers (primarily for the UBE programme), while the Curriculum of UBE (by NERDC) and FRN (2013), emphasizes BST as a core subject for the 9 years of Basic education is, to say the least deplorable. If we fail to get it right at the foundation level of instructional delivery through guaranteeing the provision of enabling environment, the envisioned super structure may be a mirage.
The theory of functionalism was employed to further justify the relevance of this study and externalise the association between the optimal provision of the enabling environment-curricular and instructional materials, human capital, effective methodological inputs and a robust BST delivery system. Functionalism as propounded by Emile Durkheim, is used in explaining that the optimal functioning of any system in human society, is dependent on the harmony existing within the constituent parts. According to Durkheim, a society/system is made up of smaller units that formed the whole and once any part is broken or removed, society/system becomes incomplete (Andersen & Taylor, 2005). Hence, effective BST instructional delivery in Nigeria is realizable to the extent the requisite enabling conditions are optimally provided. By implication, the government and all stakeholders in education are challenged to provide the needed human and infrastructural facilities for the successful teaching and learning of BST in schools.

Research Questions
A research question guided the study:
1. What are the challenges facing the teaching of BST in Anambra State secondary schools?

Method
This study adopted a descriptive survey research design. The perception of the respondents on the extent to which the identified items constituted a challenge in the effective teaching and learning of BST in schools, were collated and analyzed. The sample consisted of 661 BST teachers drawn from all the six education zones in Anambra state. The sample was proportionately drawn from each of the zones as shown in table 1
Table 1: Population and sample of BST Teachers in their Zones

<table>
<thead>
<tr>
<th>Zones</th>
<th>Aguata</th>
<th>Awka</th>
<th>Nnewi</th>
<th>Ogodi</th>
<th>Onitsha</th>
<th>Otuocha</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>850</td>
<td>1064</td>
<td>1318</td>
<td>1154</td>
<td>1479</td>
<td>750</td>
<td>6615</td>
</tr>
<tr>
<td>Sample</td>
<td>85</td>
<td>106</td>
<td>132</td>
<td>115</td>
<td>148</td>
<td>75</td>
<td>661</td>
</tr>
</tbody>
</table>

Source: Planning, research Statistics (PRS) Unit, Anambra state Universal Basic Education Board (ASUBEB), Awka.

A 21–item Questionnaire developed by the researchers was used for data collection. The Questionnaire was serialized into 4-clusters namely: Curricular Materials, Instructional Materials, Human Resource and Teaching Methodology. The instrument was pilot tested and its reliability determined. Respondents were requested to indicate their extent of agreement or disagreement with the items thus: Strongly Agree (SA=4), Agree (AG=3), Disagree (DI=2) and Strongly Disagree (SD=1).

The Validity of the instrument was ensured through the wise counsel of experts in BST and Educational measurements and Evaluation. Similarly, the reliability of the instrument was ensured through Cronbach Alpha technique and yielded an index of 0.75 which was adjudged to be high enough and reliable for the study. This technique was deemed appropriate for determining the reliability of the instrument because the items were not dichotomously scored.

The copies of the Questionnaire were administered to the respondents via a Research Assistant in each Zone. A total of 661 copies of Questionnaire were completely filled and returned. The research Questions were answered using mean rating. A cut-off point of 2.50 was adopted for decision making as the criterion. An item with a mean rating of 2.50 and above was accepted as facilitating the teaching of BST,
while the reverse holds for any item with mean rating less than 2.50, i.e. such item hinders the teaching of BST.

**Findings**

Strongly Agree (SA=4), Agree (AG=3), Disagree (DI=2) and Strongly Disagree (SD=1).

Table 2: Mean ratings of Respondents on Challenges of teaching BST

<table>
<thead>
<tr>
<th>S/N</th>
<th>A: Curricular Materials:</th>
<th>SA</th>
<th>AG</th>
<th>DA</th>
<th>SD</th>
<th>Mean</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The National Curriculum is comprehensive enough for teaching BST.</td>
<td>150</td>
<td>250</td>
<td>110</td>
<td>151</td>
<td>2.60</td>
<td>F</td>
</tr>
<tr>
<td>2.</td>
<td>BST text books are given to pupils at no cost.</td>
<td>300</td>
<td>200</td>
<td>61</td>
<td>100</td>
<td>3.03</td>
<td>F</td>
</tr>
<tr>
<td>3.</td>
<td>The contents are relevant to the Nigerian environment.</td>
<td>261</td>
<td>220</td>
<td>80</td>
<td>100</td>
<td>2.97</td>
<td>F</td>
</tr>
<tr>
<td>4.</td>
<td>BST textbooks are provided for teachers at no cost.</td>
<td>400</td>
<td>200</td>
<td>20</td>
<td>41</td>
<td>3.45</td>
<td>F</td>
</tr>
<tr>
<td>5.</td>
<td>Other recommended books are available for reference purposes</td>
<td>200</td>
<td>261</td>
<td>100</td>
<td>100</td>
<td>2.85</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td><strong>Cluster mean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.99</td>
<td>F</td>
</tr>
</tbody>
</table>

**B: Instructional Materials**

<table>
<thead>
<tr>
<th>S/N</th>
<th></th>
<th>SA</th>
<th>AG</th>
<th>DA</th>
<th>SD</th>
<th>Mean</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>A functional study room/Library is available in my school</td>
<td>20</td>
<td>80</td>
<td>361</td>
<td>200</td>
<td>1.88</td>
<td>H</td>
</tr>
<tr>
<td>7.</td>
<td>Teachers are urged to improvise teaching aids</td>
<td>261</td>
<td>220</td>
<td>80</td>
<td>100</td>
<td>2.97</td>
<td>F</td>
</tr>
<tr>
<td>8.</td>
<td>Standard laboratory for BST is available in my school</td>
<td>10</td>
<td>30</td>
<td>360</td>
<td>261</td>
<td>1.79</td>
<td>H</td>
</tr>
<tr>
<td>9.</td>
<td>There is a nature corner in my class</td>
<td>260</td>
<td>300</td>
<td>51</td>
<td>50</td>
<td>3.16</td>
<td>F</td>
</tr>
</tbody>
</table>
10. We have adequate standard instructional materials in school.  
   |   |   |   |
   | 20 | 30 | 361 | 250 | 1.73 | F |

**Cluster Mean**  
2.31 H

C: Human Resource:

11. I am a specialist BST teacher  
   |   |   |   |
   | 30 | 20 | 251 | 360 | 1.58 | H |

12. We have enough BST teachers in schools  
   |   |   |   |
   | 30 | 21 | 250 | 360 | 1.58 | H |

13. Teachers are encouraged to attend conferences/workshops.  
   |   |   |   |
   | 300 | 200 | 50 | 111 | 3.04 | F |

14. Teachers are often sponsored for further studies  
   |   |   |   |
   | 21 | 40 | 300 | 300 | 1.67 | H |

15. Science/Hazard Allowance are paid to BST teachers  
   |   |   |   |
   | 21 | 40 | 380 | 220 | 1.79 | H |

**Cluster Mean**  
1.93 H

D: Teaching Methodology:

16. Excursion/field trips are often organized for pupils  
   |   |   |   |
   | 160 | 260 | 100 | 141 | 2.66 | F |

17. I employ Discussion method in my teaching  
   |   |   |   |
   | 150 | 262 | 110 | 140 | 2.64 | F |

18. I adopt Guided Inquiry Approach in my teaching  
   |   |   |   |
   | 50 | 60 | 300 | 251 | 1.86 | H |

19. I uses lecture method in my teaching  
   |   |   |   |
   | 250 | 160 | 100 | 151 | 2.77 | H* |

20. I employ co-operative learning technique in my class  
   |   |   |   |
   | 40 | 50 | 321 | 250 | 1.82 | H |

21. ICT tools are deployed in teaching BST concepts  
   |   |   |   |
   | 55 | 55 | 351 | 200 | 1.95 | H |

**Cluster Mean**  
2.28 H

**Key:**  
F= Facilitating Effective Teaching of BST  
H= Hindering Effective Teaching of BST
Discussion
The findings of this study with respect to the challenges of Curricular materials are shown in cluster A of table 2. The mean ratings ranged from 2.60 to 3.45, all values, being above the cut-off point of 2.50. This implies that ample provision is made for curricular materials to facilitate BST teaching. Indeed the Federal Government and particularly the National Educational Research and Development Council (NERDC) is hereby commended for living up to the standards expected of them in the area of making relevant curricular materials freely available to pupils and their teachers. Perhaps, the late arrival of the recommended BST text books prompted some schools to embark on the use of other texts like Science is Discovery, Illesanmi Primary Science and Integrated Science for primary schools. These could still serve as additional reference text books.

Furthermore, on cluster B: Instructional materials, the mean ratings ranged from 1.58 to 3.16. Apart from the challenges of library, standard laboratory and instructional materials for BST, teachers are urged to improvise instructional materials and to sustain a nature corner in their classes. According to NTI-TESSA (2010:20), the teaching of BST is activity based and may not necessarily require standard apparatus for you to teach it… the child’s immediate environment serves as the foremost laboratory. Hence teachers are urged to be creative and improvise instructional materials when the standard ones are not available. Considering the fact that there is a limit to which one could improvise and taking cognizance of the pay-packet of the teachers, the authors are of the view that the government should pay more attention to provision of instructional materials for teaching BST.
From cluster C, on Human Resource, the mean ratings ranged from 1.58 to 3.04. These values indicated that non-payment of science/hazard allowance, paucity of specialist BST teachers, non-sponsorship of teachers to further studies hinder effective BST teaching. It is commendable that through such organs as National Teacher’s Institute (NTI), Federal Ministry of Education, professional Associations as Science Teachers Association of Nigeria (STAN) etc, regular in-service and refresher courses/workshops are organized to update the professional skills and competencies of BST teaches (Akpan, 2008).

The generalist approach to primary school teaching in Nigeria is a limiting factor to enriched specialized teaching of BST in primary schools. The non-specialist teachers in an attempt to teach BST may be cheating, rather than teaching the pupils. Indeed, they lack the methodological competence to handle foundation science and technology concepts (Anaekwe and Onyeji, 2003). Another worsening dimension to this problem is the unpalatable nature of pay-packet, with minimal incentive to motivate and ginger the teachers into action. The government seems to forget that planning and execution of projects, field trips, improvisation of materials etc, usually demand extra-time beyond school schedules. As such some inducements ought to be given to encourage teachers’ efforts, at least to take care of extra hours of duty and associated risks, not to talk of insurance cover to the teachers.

From cluster D Methodology, the means ratings from 1.82 to 2.77. From this table, the BST teachers adopt excursion and discussion in their teaching but still engages in the use of lecture method (2.77). The use of lecture method should be discouraged because it renders the pupil inactive. Again, the teachers appeared unfamiliar with some innovative techniques
such as cooperative learning strategy, use of ICT and guided inquiry approach which have proven to engender science teaching and learning (Nwagbo and Okoro 2012). In addition Ezeuchu (1988:4) advocated the use of scientific toys/models in order to enable pupils dismantle, play, reconstruct and copy such instruments, thereby imbibing basic process skills in science. In this way, a more pragmatic approach to laying a solid foundation for BST teaching and learning would have been ensured.

**Recommendation and Conclusion**

Based on the foregoing findings and discussions, it was concluded that attention should be paid to BST teaching and learning through taking proactive measures in providing requisite human and material resources to ensure the laying of a sound basis for scientific and technological development in Nigeria.

In this regard, it was recommended that:

i. **Libraries** should be built in schools and stocked with relevant books to enable the learners develop reading habit well on time.

ii. **BST laboratories and equipments** should be provided in schools to complement the resources available from immediate school environment.

iii. Training and recruitment of specialist BST teachers and retraining of available science teachers, is a sine qua non towards realizing the goals of teaching BST.

iv. **Regular refresher courses** are necessary to update BST teachers’ skills, knowledge of the subject matter and teaching methodology

v. **Scholarships** should be awarded to teacher-trainees who are pursuing programmes in BST and allied fields in
tertiary education as a way of salvaging the paucity of teachers in science and technology.

vi. In keeping with the global trend of computer literacy, teachers should be retrained from time to time on ICT awareness and usage.

References


